Trends in Breastfeeding Interventions, Skin-to-Skin Care, and Sudden Infant Death in the First 6 Days after Birth

Melissa Bartick, MD, MSc, FABM[1], Mary Ellen Boisvert, MSN, CLC, CLE[2,*], Barbara L. Philipp, MD, FAAP, FABM[3], and Lori Feldman-Winter, MD, MPH, FAAP, FABM[4]

Objective To determine if implementation of skin-to-skin care and the Baby-Friendly Hospital Initiative (BFHI) contributes to sudden unexpected infant death (SUID) and asphyxia in the first 6 days after birth.

Study design Survey data were used to determine a correlation between BFHI and deaths from SUID and asphyxia among infants <7 days in the US and Massachusetts. Using data from the Centers for Disease Control and Prevention, implementation of BFHI was tracked from 2004-2016 and skin-to-skin care was tracked from 2007-2015. Using data from Centers for Disease Control and Prevention WONDER and the Massachusetts Department of Public Health, SUID and asphyxia were tracked from 2004-2016.

Results Nationally, births in Baby-Friendly facilities rose from 1.8% to 18.3% and the percentage of facilities in which most dyads experienced skin-to-skin care rose from 40% to 83%. SUID prevalence among infants <7 days was rare (0.72% of neonatal deaths) and decreased significantly from 2004-2009 compared with 2010-2016, from 0.033 per 1000 live births to 0.028, OR 0.85 (95% CI 0.77, 0.94). In Massachusetts, births in Baby-Friendly facilities rose from 2.8% to 13.9% and skin-to-skin care rose from 50% to 97.8%. SUID prevalence decreased from 2010-2016 compared with 2004-2009: OR 0.32 (95% CI 0.13, 0.82), with 0 asphyxia deaths during the 13-year period.

Conclusion Increasing rates of breastfeeding initiatives and skin-to-skin care are temporally associated with decreasing SUID prevalence in the first 6 days after birth in the US and Massachusetts. *(J Pediatr 2019; ■:1-5).*

See editorial, p ••• and related article, p •••

According to a 2018 study, 29.2% of neonatal sudden unexpected infant deaths (SUIDs) occur in the first 6 days after birth.[1] Another recent publication by the same authors used mortality data from the Massachusetts Department of Public Health to assert that such deaths in infants under 6 days of age are "more common than previously recognized."[2] These articles called into question the safety of hospital-based practices. The authors suggested breastfeeding interventions, particularly skin-to-skin care, may be responsible for the deaths by causing fatal sudden unexpected postnatal collapse (SUPC). Concerns emerged as to whether skin-to-skin care and breastfeeding interventions are associated with an increased risk of death.[3,4] Neither publication examined trends around implementation of skin-to-skin care or other breastfeeding interventions to look for correlation. Furthermore, neonatal SUID is quite uncommon, representing only 2.6% of all neonatal deaths (2007-2017).[5]

SUID is an over-arching term for all unexpected infant deaths and the Centers for Disease Control and Prevention (CDC) defines it as comprising 3 *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* codes.[6] Of these, 2 codes consist of causes of death that remain unexplained: sudden infant death syndrome (SIDS, R95) and ill-defined and unknown (R99), and one in which a causal explanation is eventually found, accidental suffocation and strangulation in bed (ASSB, W75), which can occur on any surface.

SUPC is a rare and potentially fatal event occurring in an otherwise healthy newborn and may be defined as any condition resulting in temporary or

ASSB	Accidental suffocation and strangulation in bed
BFHI	Baby-Friendly Hospital Initiative
CDC	Centers for Disease Control and Prevention
SIDS	Sudden infant death syndrome
SUID	Sudden unexpected infant death
SUPC	Sudden unexpected postnatal collapse

From the [1]Department of Medicine, Cambridge Health Alliance and Harvard Medical School, Cambridge, MA; [2]College of Nursing, University of Massachusetts, Dartmouth, MA; [3]Department of Pediatrics, Boston University School of Medicine, Boston, MA; and [4]Department of Pediatrics, Cooper Medical School of Rowan University, Camden, NJ

*Deceased

M.B. and B.P. co-lead the Massachusetts Baby-Friendly Collaborative. M.E.B. was also a leader at the Massachusetts Baby Friendly Collective until her death in September 2019. M.B. has received funding from the W.K. Kellogg Foundation for research in breastfeeding and economics. B.P. has received funding from the W.K. Kellogg Foundation to support the Mother-Baby Summits. L.F-W. works as a consultant and physician lead for Communities and Hospitals Advancing Maternity Practices (CHAMPS), Boston Medical Center, Boston, Massachusetts, and as a consultant to National Institute for Children's Health Quality (NICHQ)-National Action Partnership to Promote Safe Sleep-Improvement and Innovation Network (NAPPSS-IIN).

https://doi.org/10.1016/j.jpeds.2019.09.069

permanent cessation of breathing, cardiorespiratory failure, suffocation, or entrapment. A disproportionate number of SUPC cases have been described in the first 2 hours after birth.[7] Descriptive case report data suggest that newborns in the early hours after birth may be particularly vulnerable to airway compromise and asphyxiation if they are not held properly by fatigued, distracted, medicated, or inexperienced caregivers.[7-9] Recognizing this risk, the American Academy of Pediatrics published guidelines in 2016 for staffing, surveillance, and positioning for safe skin-to-skin care in the hospital to prevent SUPC.[10] As there is no diagnostic code for SUPC, fatal cases of SUPC would be expected to receive 1 of the 3 diagnostic codes assigned to SUID, with ASSB being the expected code for infants who die by asphyxia while skin-to-skin.

In April 2010, The Joint Commission adopted the rate of exclusive breast milk feeding as part of the Perinatal Care Core Measure set. In 2011, the National Collaboration for Action on the Ten Steps was formed.[11] Beginning in 2012, the Centers for Disease Control and Prevention sponsored initiatives to increase the numbers of US Baby-Friendly hospitals.[12] Skin-to-care, although initially promoted as a breastfeeding intervention to enable latch during the first hour after birth, is now recognized as a standard of care for all infants regardless of feeding method for its benefits with stabilization of newborn body temperature and glucose, bonding, and decrease in maternal stress.[10,13]

It is important to understand whether skin-to-skin care and the Baby-Friendly Hospital Initiative (BFHI) contribute to SUPC and SUID. Thus, we sought to determine if these initiatives are correlated with SUID in general and with asphyxia (ASSB) in particular during the first 6 days after birth.

Methods

We used data from the CDC Breastfeeding Report Card[14] and the Massachusetts Baby-Friendly Collaborative[15] to track the percentage of births in Baby-Friendly facilities per year. We were supplied with unpublished data from the Massachusetts Department of Public Health for SUID within 6 days after birth. We specifically requested the same data set supplied to the lead author of the Massachusetts article and were told we were given the same data set.[16] Following CDC's example for privacy concerns, we are suppressing the reporting of yearly numbers of Massachusetts infant deaths as they always fewer than 10 per year.

We used results of the CDC's Maternity Practice in Infant Nutrition and Care biannual surveys[17] for national data on implementation of skin-to-skin care in the first hour after birth for healthy term vaginal births. We used the Breastfeeding Report Cards[14] for the percentage of births in Baby-Friendly facilities for national data.

We used the CDC WONDER interactive linked birth-death database[18] to track infant deaths by year and cause of death from 2004-2016 for the first 6 days after birth. SUID (the sum of all 3 codes) and ASSB in particular were used as they were considered the best proxies for fatal SUPC. Although ASSB would capture asphyxia deaths, SUID would ensure other potential diagnoses are captured.

We divided the timeframes before and after The Joint Commission mandate in 2010, choosing 2004 as the start date as that is the earliest date from the Breastfeeding Report Cards. The study was exempted by the Cambridge Health Alliance Institutional Review Board.

Results

Nationally, the percentage of births in Baby-Friendly facilities rose from 1.8% in 2004 to 18.3% in 2016[14] (**Figure 1**). The percentage of hospitals where "most" mother-infants pairs experienced skin-to-skin contact for at least 30 minutes within 1 hour of an uncomplicated vaginal birth rose from 40.4% in 2007 to 83.0% in 2015 (**Figure 2**).[17]

Nationally, SUID prevalence within the first 6 days after birth decreased significantly between the 2 study periods[18] (**Table**). Aggregate ASSB prevalence during the 2 study periods increased significantly (**Table**), but national ASSB deaths within in the first 6 days after birth remained under 20 deaths annually, a number too low to be considered reliably precise by the CDC[18] (**Table** and **Figure 3**). The sustained jump in ASSB in 2012 was accompanied by a corresponding sustained decrease in SIDS (**Figure 3**).

Overall from 2004-2016, 40.1% of national SUID deaths were in preterm infants. A disproportionately high percentage of SUID deaths during the first 6 days after birth were in non-Hispanic black infants,[5] although this dropped markedly during the study period. Only 0.72% of neonatal deaths from 2004-2016 were due to SUID in infants in the first 6 days after birth.[18]

In Massachusetts, the percentage of births in Baby-Friendly facilities grew from 2.8% in 2004 to 13.6% in 2016[19,20] (**Figure 1**). The percentage of Massachusetts hospitals where "most" mother-infants pairs experienced skin-to-skin contact for at least 30 minutes within 1 hour of an uncomplicated vaginal birth rose from 50% in 2007 steadily to 97.8% in 2015 (**Figure 2**).[17]

The SUID prevalence decreased between the 2 study periods[16] (**Table**). However, the numerators for these deaths are below the CDC's threshold for reliability and precision for reporting as prevalence rates per 1000 live births. The total number of Massachusetts SUID deaths within 6 days after birth over this 13-year period is very small (n = 22). There were zero ASSB deaths (W75) during this 13-year period.

Discussion

Increased implementation rates for skin-to-skin care and the Baby-Friendly Hospital Initiative are associated with

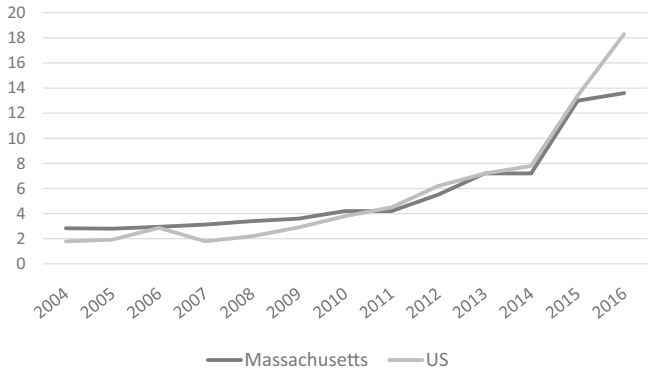

Figure 1. Percentage of births in Baby-Friendly facilities, 2004-2016.

a decrease in SUIDs, both nationally and in Massachusetts. This association may not be causal, but these data also suggest that breastfeeding interventions and skin-to-skin care do not contribute to perinatal deaths on a population level. Early initiation of breastfeeding within 1 hour of birth is associated with improved neonatal mortality rates.[21]

It is important to demonstrate that implementation of the Ten Steps and skin-to-skin care are associated with a decrease in deaths in the first 6 days after birth and not an increase in death, to avoid public perception that such practices are inherently dangerous. For instance, the publication which cited Massachusetts mortality data concluded that BFHI led to 'unintended consequences'[22] and was quoted in *Time* magazine[3] stating, "emerging evidence that full compliance the 10 steps of the [Baby-Friendly Hospital] initiative may inadvertently be promoting potentially hazardous practices and/or having counterproductive outcomes." The story reported that the authors of this publication "worry that rooming-in could lead to mothers' accidentally smothering their children and possibly contribute to sudden unexpected postnatal collapse…" Skin-to-skin care is now universally practiced in Massachusetts and is practiced in the majority of US births, yet SUID prevalence in Massachusetts significantly decreased. Despite skin-to-skin care practices having doubled nationally, US ASSB rates remained tiny and too small to report with precision, and SUID rates significantly decreased.

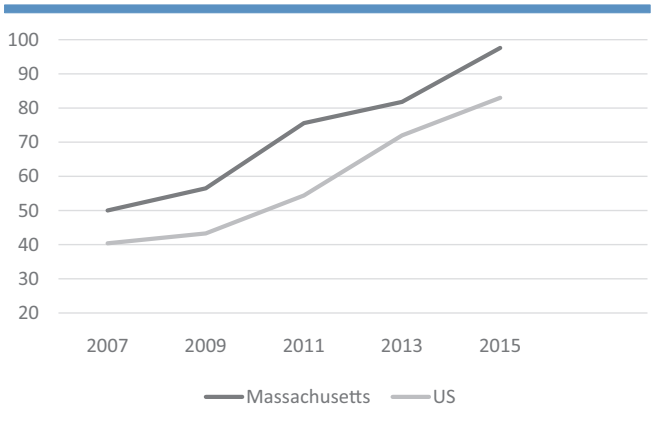

Figure 2. Percentage of maternity facilities in which most dyads experience skin-to-skin care in the first hour.

The fact that 40% of these deaths occur in preterm infants is notable, and this percentage has significantly decreased during the study period of 2004-2016 (**Table**). These infants are particularly vulnerable and have a disproportionately high prevalence of SIDS and ASSB at older ages as well.[23,24] Breastfeeding and breast milk feeding are especially important in this population. Kangaroo Mother Care has been found to be effective for stabilized preterm infants,[25] and it is important that it be done safely.

Skin-to-skin care requires increased surveillance in the first hours or days after birth, an issue which was addressed by the 2016 American Academy of Pediatrics guidelines.[10] More research is needed to see if such guidelines will be effective, a difficult task given that SUPC is not being systemically surveilled, nor can it be without an *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* code. Our data demonstrate that the public can be reassured that skin-to-skin care and the BFHI are not resulting in increase in hospital deaths (or early post-hospital deaths), and in fact, that the overall prevalence of such deaths is decreasing.

It is important to note that ASSB prevalence was extremely low, despite the sustained jump in 2012. Furthermore, this jump, accompanied by a drop in SIDS prevalence, suggests a change in coding practice rather than a true rise in asphyxia deaths (**Figure 3**). This was likely part of the well-described trend in diagnostic shift away from SIDS (R95) and toward ASSB (W75) and ill-defined (R99), even in identical hypothetical circumstances.[26] Thus, the increase in ASSB does not necessarily mean that more infants were dying of suffocation, only that the deaths were coded that way.

These data reinforce previous data that SUID, SIDS, and ASSB occur disproportionately in the non-Hispanic black population.[24,27] These data show the disparity begins as early as the first 6 days after birth. These findings have implications for hospital care of this population, and as well as prenatal and early post-discharge care, as other studies suggest black women and infants are less likely to receive evidence-based care in the maternity setting than whites.[28,29] The reason for the improvement in the disparity after 2010 is also unclear and requires further research.

We acknowledge several limitations in our study. We were unable to quantify the implementation of the Ten Steps in facilities nationally or in Massachusetts for each year. Designation as a Baby-Friendly facility is the final step in a process that takes years, and the percentage of births in Baby-Friendly facilities thus underestimates the degree to which hospitals are implementing the Ten Steps.

Table. SUID prevalence characteristics, infants <7 days of age, US and Massachusetts, 2004-2016

	2004-2009	2010-2016	OR 2010-2016 compared with 2004-2009	95% CI
US SUID prevalence	0.033	0.028	0.85	(0.77, 0.94)
US ASSB prevalence	0.002	0.003	1.41	(1.02, 1.94)
US preterm SUID prevalence	0.014	0.011	0.74	(0.64, 0.87)
% SUID that are preterm, US	43.7%	38.0%	0.74	(0.64, 0.87)
%. SUID are non-Hispanic white, US (% of US births that are non-Hispanic white)	52.7% (54.2%)	53.3% (46.2%)	1.17	(0.96, 1.42)
% SUID are non-Hispanic black US (% of US births that are non-Hispanic Black)	39.0% (14.4%)	21.8% (14.8%)	0.56	(0.45,0.69)
SUID prevalence non-Hispanic white	0.030	0.032	1.08	(0.94, 1.24)
SUID prevalence non-Hispanic Black	0.089	0.036	0.40	(0.34, 0.49)
MA SUID prevalence	unreliable	unreliable	0.32	(0.13, 0.82)
MA ASSB prevalence	0	0	0	Not applicable

Prevalence is noted as "unreliable" if the numerator is <20, making a calculation of prevalence unreliably precise by CDC standards. Prevalence rates are per 1000 live births.

For example, in 2016, Massachusetts had 13.6% of births in designated facilities, but in 2019, 36% of births took place in such facilities,[20] reflecting the fact that many facilities had implemented some of those 10 Steps in 2016. In addition, the lack of a quantifiable increase in deaths with increased implementation of skin-to-skin care and the 10 Steps does not mean that the occasional tragedy does not occur. Thus, it is essential that the published guidelines for safety around skin-to-skin in the hospital are followed. Finally, our study does not attempt to explain the decrease in SUID and does not ascribe it to the increase in breastfeeding interventions and skin-to-skin care. Further research would be required.

Over the last decade, increased implementation of the Ten Steps and skin-to-skin care were associated with decreased rates of SUID within 6 days of age. Adherence to guidelines to prevent SUPC remains important, but the practices of skin-to-skin care, rooming-in and the 10 Steps appear to be safe. ■

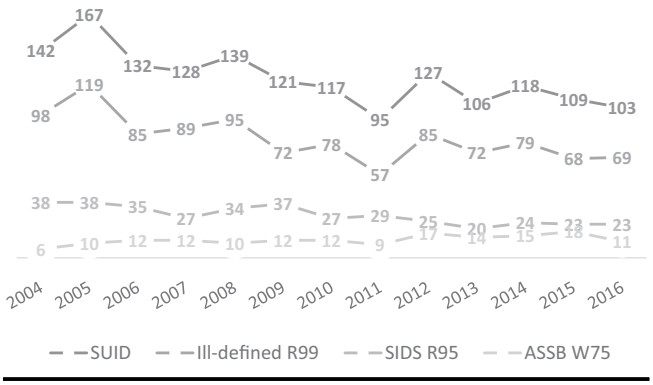

Figure 3. Trends in US deaths per year among infants <7 days of age, 2004-2016. Total deaths are shown rather than prevalence because of the very low numbers of ASSB deaths, preventing a reliably precise calculation. Total births increased from 4 112 055 in 2004 to 4 316 213 in 2007, then declined to 3 945 875 in 2016.

We acknowledge the work of the Massachusetts Baby-Friendly Collaborative, founded in 2008, which has served as a national model.[30]

Submitted for publication Jul 15, 2019; last revision received Aug 28, 2019; accepted Sep 25, 2019.

Reprint requests: Melissa Bartick, MD, MSc, FABM, Department of Medicine, Cambridge Health Alliance, 1493 Cambridge St, Cambridge, MA 02139.
E-mail: mbartick@challiance.org

References

1. Bass JL, Gartley T, Lyczkowski DA, Kleinman R. Trends in the incidence of sudden unexpected infant death in the newborn: 1995-2014. J Pediatr 2018;196:104-8.
2. Bass JL, Gartley T, Kleinman R. Unintended consequences of current breastfeeding initiatives. JAMA Pediar 2016;170:923-4.
3. Howorth C. Motherhood is hard to get wrong: why do so many moms feel so bad about themselves? Time; 2017. p. 2017.
4. Weintraub K. Study: Conflicting Information about SIDS can Prove Lethal. USA TODAY; 2018.
5. Centers for Disease Control and Prevention. CDC WONDER Linked Birth/Infant Death Records. Atlanta: US Department of Health and Human Services; 2019. https://wonder.cdc.gov/lbd-current.html. Accessed August 19, 2019.
6. Centers for Disease Control and Prevention. Sudden Unexpected Death and Sudden Infant Death Syndrome: Data and Statistics. Atlanta: US Department of Health and Human Services; 2019. https://www.cdc.gov/sids/data.htm. Accessed August 20, 2019.
7. Rodriguez-Alarcon J, Melcor JC, Fernandez-Llebrez L, Uria C. Episodios aparentemente letales en las primeras do hora de vida durante el contacto piel con piel: incidencia y factores de riesgo. [Apprently life-threatening episodes in the first two hours aduring skin-to-skin mother-infant contact: Incidence and risk factors]. Progresos de Obstetica y Ginecologi 2011;54:55-9.
8. Lutz TL, Elliott EJ, Jeffery HE. Sudden unexplained early neonatal death or collapse: a national surveillance study. Pediatr Res 2016;80:493-8.
9. Poets A, Steinfeldt R, Poets CF. Sudden deaths and severe apparent life-threatening events in term infants within 24 hours of birth. Pediatrics 2011;127:e869-73.
10. Feldman-Winter L, Goldsmith JP. Committee on fetus and newborn, task force on sudden infant death syndrome. Safe sleep and skin-to-

skin care in the neonatal period for healthy term newborns. Pediatrics 2016;138:e20161889.
11. Carolina Global Breastfeeding Institute. CGBI: National Collaborative for Advancing the Ten Steps. Durham: UNC Gillings School of Global School of Public Health; 2018. https://sph.unc.edu/cgbi/ncats/.
12. Feldman-Winter L, Ustianov J, Anastasio J, Butts-Dion S, Heinrich P, Merewood A, et al. Best fed beginnings: a nationwide quality improvement initiative to increase breastfeeding. Pediatrics 2017;140. e20163121.
13. Moore ER, Bergman N, Anderson GC, Medley N. Early skin-to-skin contact for mothers and their healthy newborn infants. Cochrane Database Syst Rev 2016;11:CD003519.
14. Centers for Disease Control and Prevention. Breastfeeding Report Cards Atlanta. GA US Department of Health and Human Services; 2018. https://www.cdc.gov/breastfeeding/data/reportcard.htm. Accessed April 13, 2019.
15. BID Plymouth is 13th Baby-Friendly Facility. Massachusetts Breastfeeding Coalition. BID Plymouth is 13th Baby-Friendly Facility Weston, MA. 2018. https://massbreastfeeding.org/2018/04/09/bid-plymouth-is-13th-baby-friendly-facility/. Accessed July 10, 2019.
16. Egan J. Linked birth-death file, ICD-10 Codes R95, W75, R99, age <6 days. In: Bartick M, ed. Boston: Massachusetts Department of Public Health; 2019.
17. Centers for Disease Control and Prevention. mPINC Survey Results: Maternity Practices: Survey Resuls, 2007-2015 mPINC surveys. Atlanta: U.S. Department of Health and Human Services; 2019. https://www.cdc.gov/breastfeeding/data/mpinc/results-tables.htm. Accessed March 27, 2019.
18. CDC WONDER Linked Birth/Infant Death Records. U.S. Department of Health and Human Services; 2018 [cited April 25, 2019]. https://wonder.cdc.gov/lbd.html. Accessed Nov 25, 2018.
19. Centers for Disease Control and Prevention. Breastfeeding Report Cards. Atlanta, GA: US Department of Health and Human Services; 2016. clinicaltrials.gov/show/NCT02313181. Accessed Nov 3, 2016.
20. Massachusetts Breastfeeding Coalition. Baby-Friendly hospitals in Massachusetts Weston. MA Masschusetts Breastfeeding Coalition; 2019. https://massbreastfeeding.org/baby-friendly-hospitals-in-massachusetts/. Accessed July 10, 2019.
21. Smith ER, Hurt L, Chowdhury R, Sinha B, Fawzi W, Edmond KM, et al. Delayed breastfeeding initiation and infant survival: a systematic review and meta-analysis. PLoS One 2017;12:e0180722.
22. Baddock SA, Tipene-Leach D, Williams SM, Tangiora A, Jones R, Iosua E, et al. Wahakura versus bassinet for safe infant sleep: a randomized trial. Pediatrics 2017;139:e20160162.
23. Ostfeld BM, Schwartz-Soicher O, Reichman NE, Teitler JO, Hegyi T. Prematurity and sudden unexpected infant deaths in the United States. Pediatrics 2017. e20163334:1-8.
24. Erck Lambert AB, Parks SE, Cottengim C, Faulkner M, Hauck FR, Shapiro-Mendoza CK. Sleep-related infant suffocation deaths attributable to soft bedding, overlay, and wedging. Pediatrics 2019;143:e20183408.
25. Conde-Agudelo A, Diaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. Cochrane Database Syst Rev 2016;CD002771.
26. Shapiro-Mendoza CK, Parks SE, Brustrom J, Andrew T, Camperlengo L, Fudenberg J, et al. Variations in cause-of-death determination for sudden unexpected infant deaths. Pediatrics 2017;140. e20170087.
27. Bartick M, Tomori C. Sudden infant death and social justice: a syndemics approach. Matern Child Nutr 2018e12652.
28. Lind JN, Perrine CG, Li R, Scanlon KS, Grummer-Strawn LM, Centers for Disease C, et al. Racial disparities in access to maternity care practices that support breastfeeding–United States, 2011. MMWR Morb Mortal Wkly Rep 2014;63:725-8.
29. McKinney CO, Hahn-Holbrook J, Chase-Lansdale PL, Ramey SL, Krohn J, Reed-Vance M, et al. Racial and ethnic differences in breastfeeding. Pediatrics 2016;138:e20152388.
30. Bartick M, Edwards RA, Walker M, Jenkins L. The Massachusetts baby-friendly collaborative: lessons learned from an innovation to foster implementation of best practices. J Hum Lact 2010;26:405-11.